REMARKS

Claims 12-15 and 18-33 are pending and remain for consideration. Claim 12 is amended herein.

Claims 12-15 and 18-33 are rejected under 35 U.S.C. §112, second paragraph, as allegedly being incomplete for omitting essential elements, such omission amounting to a gap between the elements. The omitted elements are: the particular location of the sensors. As noted in the specification, the "Hall elements 10 to 13 are always arranged underneath the ferromagnetic core" (See Spec. at paragraph 0025). The rejection is traversed and reconsideration is respectfully requested.

Paragraph 0025 is a part of the description ranging from paragraph 0021 to paragraph 0032 that discloses a first embodiment of the invention. Paragraph 0025 discloses that "*As read-out sensors 5 and 6, the magnetic field sensor preferably has four so-called horizontal Hall elements 10, 11, 12 and 13 coupled in pairs that are sensitive to a magnetic field that runs vertically to the surface of the semiconductor chip l, ie, that runs in z direction.*" The last paragraph 0055 discloses that "*instead of the horizontal Hall elements 10-13 it is also possible to use so-called vertical Hall elements that are sensitive to a magnetic field that runs parallel to the surface. From Fig. 2 it follows that, instead of on the outer edge underneath the ferromagnetic core 4, the vertical Hall elements have to be arranged somewhat outside the ferromagnetic core 4 where the field lines run almost horizontally.*" Claim 12 specifies that "the read-out sensor comprises at least one sensor that is integrated into the semiconductor chip and arranged in the vicinity of an outer edge of the ferromagnetic core". While horizontal Hall elements have to be placed at the outer edge underneath the ferromagnetic core 4, vertical Hall elements have to be placed somewhat outside the ferromagnetic core 4. In both cases the Hall elements have to be placed in the vicinity of the ferromagnetic core as recited in independent claims 12 and 29. Accordingly, claims 12 and 29 are not missing an essential element and the rejection of claims 12-15 and 18-33 should be withdrawn and claims 12-15 and 18-33 allowed.

Claims 12, 18, 21 and 29 are rejected on the ground of nonstatutory obviousness-type double patenting as allegedly being unpatentable over claims 1 and 3 of U.S. Patent No. 7,038,448 to Schott in view of Tong et al. (U.S. Pat. No. 5,199,178). The rejection is traversed and reconsideration is respectfully requested.

Amended claim 12 recites *an excitation coil and a first electronic circuit for the temporary application of a current to the excitation coil in order to restore the predetermined magnetization in the ferromagnetic core,* while claim 1 of Schott recites *a current source for applying an AC current to the exciter coil, the exciter coil and the ferromagnetic core serving for chopping the first and second component of the magnetic field.* The Examiner recognizes that the invention in Schott's patent and Applicants' invention may be different in operation, but he concludes that the claims are not so limited and the rejections stand. Applicants respectfully submit that amended claim 12 includes limitations not shown by Schott:

1. Schott teaches to operate his sensor as a fluxgate sensor and discloses an electronic circuit 7 that serves to produce the current flowing through the exciter coil 2 and the evaluation of the signals delivered by the read-out sensors 5, 6. The electronic circuit 7 operates Schott's sensor as a fluxgate sensor. It is the only circuit having only one function. Schott does not disclose a first and a second electronic circuit, the first electronic circuit for the temporary application of a current to the excitation coil in order to restore the predetermined magnetization in the ferromagnetic core and the second electronic circuit for the operation of the first electronic circuit, the read-out sensor and for processing a signal delivered by the read-out sensor as recited in amended claim 12.

2. Schott does not disclose bringing the ferromagnetic core to a predetermined magnetization. Even if in operation as a fluxgate sensor the magnetization of the ferromagnetic core is driven with a predetermined frequency into magnetic saturation and out of magnetic saturation, this does not mean that the ferromagnetic core is magnetized with the predetermined magnetization at the end of the

operation. This would only happen if the operation of the fluxgate sensor would be stopped under controlled conditions, i.e. then when the current flowing through the exciter coil would be switched off after returning to zero always from a positive value or always from a negative value. As is well known to the person skilled in the art, ferromagnetic materials show a hysteresis effect, which means that the ferromagnetic material shows a certain magnetization the value of which depends on the direction the external magnetic field has before it disappears. In this case the current flowing through the exciter coil produces this external magnetic field. Schott is completely silent on this. So the magnetization of the ferromagnetic core has different random values at the end of each operation cycle. In contrast to this, the present invention as recited in claim 12 comprises *an electronic circuit for the temporary application of a current to the excitation coil in order to restore the predetermined magnetization in the ferromagnetic core.*

Therefore amended claim 12 and claim 29 of the present application are not obvious over independent claim l and dependent claim 3 of Schott et al. in view of Tong et al.

Moreover, Claims 18 and 21 each depend from and thereby incorporate the limitations of amended claim 12. Accordingly, claims 18 and 21 are not obvious over Schott et al. in view of Tong for at least the reasons set forth for amended claim 12.

The rejection of claims 12, 18, 21 and 29 on the ground of nonstatutory obviousness-type double patenting should therefore be withdrawn and claims 12, 18, 21 and 29 allowed.

Claims 12-15 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Tong et al. (U.S. Pat. No. 5,199,178). The rejection is traversed and reconsideration is respectfully requested.

Tong et al. discloses a thin film magnetic fluxgate compass having a supporting substrate on which a layer of high permeability material and at least two layers of nonmagnetic conducting materials are deposited (see abstract). Tong et al.

does not disclose a semiconductor chip. The substrate of Tong's sensor is a nonmagnetic substrate made of silicon or glass or ceramic or aluminum oxide (Col. 5, lines 54 to 57). This substrate has the only function to serve as support. Tong does not disclose that the substrate is a semiconductor chip having a surface with integrated circuits.

Tong et al. also does not disclose a read-out sensor comprising at least one sensor that is integrated into the semiconductor chip and arranged in the vicinity of an outer edge of the ferromagnetic core.

Furthermore, the coils of Tong et al. are not arranged in the vicinity of an outer edge of the ferromagnetic core, but the coils are wound around the core(s) (see abstract).

Tong et al. does not show any circuitry for the operation of its sensor. Tong et al. only generally mentions that the sensing coils are connected externally to electrical circuits to provide output voltage signals to determine the angle between the magnetic core and an external magnetic field whenever the excitation coil is energized by a not shown pulse generator (Col. 5, lines 39 to 44). The pulse generator produces current pulses that flow through the excitation coils for operating the sensor as a fluxgate sensor. However, as mentioned above, it cannot be said which magnetization the ferromagnetic core has at the end of the measurement and Tong et al. is completely silent on this.

Having shown that the magnetic field sensors of Tong et al. and of the present invention as recited in amended claim 12 are structurally different, the rejection of amended claim 12 under 35 U.S.C. § 102(b) should be withdrawn and amended claim 12 allowed.

Finally, Tong et al. does not disclose a first electronic circuit for the temporary application of a current to the excitation coil in order to restore the predetermined magnetization in the ferromagnetic core, and a second electronic circuit for the

operation of the first electronic circuit, the read-out sensor and for processing a signal delivered by the read-out sensor as recited in amended claim 12.

Having shown that the thin film magnetic compass of Tong et al. and the magnetic field sensor as recited in amended claim 12 have a completely different structure, it cannot be maintained that Tong et al. anticipates amended claim 12. Therefore the rejection of amended claim 12 under 35 U.S.C. 102(b) should be withdrawn and amended claim 12 allowed.

Moreover, Fig. 10 of Tong et al. does not show the direction of the magnetization of the core. Tong does not mention a circular magnetization and the magnetization cannot be depicted from the drawings or from the orientation of the coil with regard to the core. The direction of the magnetization of the core is an inherent property that is not visible from the outside.

Accordingly, it cannot be maintained that Tong et al. anticipates claim 13. Therefore the rejection of claim 13 under 35 U.S.C. §102(b) should be withdrawn and claim 13 allowed.

Claims 13-15 depend directly or indirectly from amended claim 12 and therefore incorporate the limitations of amended claim 12. Accordingly, these dependent claims are not anticipated by Tong et al. and therefore should be allowable for at least the same reasons set forth for amended claim 12.

Claims 12-15, 18-23, 29, 30, 32 and 33 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Extance et al. (U.S. Pat. No. 4,692,703) in view of Tong et al. (U.S. Pat. No. 5,199,178). The rejection is traversed and reconsideration is respectfully requested.

Extance et al. discloses a magnetic field sensor that is operated as a fluxgate magnetometer. The fluxgate magnetometer as shown in figure 3 comprises two flat rectangular metallic glass cores 11 and 12. Fluxgate operation means that the metallic glass cores are driven with a given frequency into positive magnetic saturation and negative magnetic saturation, i.e., the magnetization of the cores

changes its direction all the time. This is shown in figure 2b. A Hall effect chip 13 is disposed between the end portions of the two cores 11 and 12. Figure 4 shows another embodiment where the metallic glass cores are combined into a single core with a closed loop configuration in order to detect circular magnetic fields such as produced by a DC current passing down a wire extending through the loop. However, also with this configuration the Hall effect chip 13 is disposed between the end portions of the single core 11'. The fluxgate magnetometer of Extance differs from the magnetic field sensor as recited in amended claim 12 at least as follows:

The fluxgate magnetometer of Extance et al. has either two rectangular cores 11 and 12 or a single core 11' formed into a loop with an air gap between the end portions and a Hall effect chip placed in the air gap. Extance et al. does not disclose a ring-shaped ferromagnetic core, i.e., a core without an air gap, that is attached to a semiconductor chip and a read-out sensor comprising at least one sensor that is integrated into the semiconductor chip and arranged in the vicinity of an outer edge of the ferromagnetic core as recited in amended claim 12.

Applicants respectfully submit that the equalization of a core with a gap and a ring-shaped core is not admissible, but is a misinterpretation and it cannot be maintained that Extance et al. discloses a ring-shaped core.

Extance et al. does not disclose a first electronic circuit for the temporary application of a current to the excitation coil in order to restore the predetermined magnetization in the ferromagnetic core, and a second electronic circuit for the operation of the first electronic circuit, the read-out sensor and for processing a signal delivered by the read-out sensor as recited in amended claim 12.

Neither Extance et al. nor Tong et al. disclose a semiconductor chip and therefore cannot disclose a sensor that is integrated into the semiconductor chip as recited in amended claim 12.

For at least the reasons set forth above, it cannot be maintained that claim 12 is obvious over Extance et al. in view of Tong et al. Therefore the rejection of

amended claim 12 under 35 U.S.C. §103(a) should be withdrawn and amended claim 12 allowed.

With regard to claim 13 of the present application, Extance et al. is silent as to how the core is magnetized. Extance et al. does not mention a circular magnetization, and the magnetization cannot be depicted from the drawings or from the orientation of the coil with regard to the core.

Claims 13-15 and 18-23 depend directly or indirectly from amended claim 12 and therefore incorporate the limitations of amended claim 12. Accordingly, these dependent claims are unobvious and therefore allowable for at least the same reasons set forth for amended claim 12.

As explained in detail above, Extance et al. discloses a magnetic field sensor provided with an excitation coil for operating the magnetic field sensor as a fluxgate magnetometer. The calibration coil is used to magnetically saturate the core in alternating directions during the measurement. In contrast to this claim 29 discloses a method for operating a magnetic field sensor with which the ferromagnetic core of the sensor is initially magnetized with a predetermined magnetization and with which the predetermined magnetization is from time to time, between the measurements, restored to the predetermined magnetization by temporary application of a current to an excitation coil. Apart from the structural differences between the magnetic field sensor of Extance et al. and the magnetic field sensor as recited in claim 29, the method steps are completely different and serve for different purposes. The core of the magnetic field sensor of Extance et al. is <u>permanently</u> driven in and out of saturation, whereas with the present invention the magnetization of the core is restored to a predetermined value <u>at specific times</u> only. "At specific times" is certainly not the same as "permanently".

Furthermore, in the Office Action the Examiner has withdrawn the rejections under §102 applying Extance et al. individually. As Tong et al. does not disclose any

method step that goes beyond the disclosure of Extance et al., it cannot be maintained that claim 29 is obvious over Extance et al. in view of Tong et al.

For at least these reasons, the rejection of claim 29 under 35 U.S.C. § 103(a) should be withdrawn and claim 29 allowed.

Claims 30, 32 and 33 depend directly or indirectly from claim 29 and therefore incorporate the limitations of claim 29. Accordingly, these dependent claims are allowable for at least the same reasons set forth for claim 29.

Claims 24-28 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Extance et al. in view of Tong et al. The rejection is traversed and reconsideration is respectfully requested.

Claims 24-28 depend directly or indirectly from claim 12. As explained in detail above, neither Extance et al. nor Tong et al. disclose the features of claim 12. Tong et al. discloses a diameter of the core to lie between 0.1 and 20 mm, but Tong et al. is silent on the relation between the width and the diameter of the core. Accordingly, it cannot be maintained that Extance et al. and Tong et al. taken either alone or in combination render the present invention as recited in claims 24-28 obvious, and therefore the rejection of claims 24-28 should be withdrawn.

Claims 24, 25 and 26 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Tong et al. The rejection is traversed and reconsideration is respectfully requested.

Claims 24, 25 and 26 depend directly or indirectly on claim 12. As explained in detail above, Tong et al. does not disclose the features of claim 12. Tong et al. discloses a diameter of the core to lie between 0.1 and 20 mm, but Tong et al. is silent on the relation between the width and the diameter of the core. Accordingly, it cannot be maintained that Tong et al. renders the present invention as recited in claims 24, 25 and 26 obvious, and therefore the rejection of claims 24, 25 and 26 should be withdrawn.

In view of the foregoing, it is respectfully submitted that claims 12-15 and 18-33 are in condition for allowance. All issues raised by the Examiner having been addressed, an early action to that effect is earnestly solicited.

No fees or deficiencies in fees are believed to be owed. However, authorization is hereby given to charge our Deposit Account No. 13-0235 in the event any such fees are owed.

Respectfully submitted,

By /Daniel G. Mackas/
Daniel G. Mackas
Registration No. 38,541
Attorney for Applicants

McCORMICK, PAULDING & HUBER LLP
CityPlace II, 185 Asylum Street
Hartford, CT 06103-3402
(860) 549-5290